mainroads WESTERN AUSTRALIA

Requirements for the use of Truck Mounted Attenuators in WA – Code of Practice

March 2025

Document Control

Owner	Executive Director Planning and Technical Services
Custodian	Road Safety Policy Manager
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Amendments

Revision Number	Revision Date	Description of Key Changes	Section / Page no.
0	July 2017	Original	All
1.0	December 2021	Title Change Adoption of the Austroads Guide to Temporary Traffic Management and AS1742.3-2019 Mandatory use of TMA – during TM set up / pack up for scenario 1 and 2 Mandatory use of TMAs on High-Speed Grade Separated roads New section – MASH TL-2 TMAs Mobile works to be in accordance with AGTTM and the Traffic Management for Works on Roads Code of Practice. Removal of Diagrams 8, 9, 10 and 11 Update to IPPV requirements MASH adoption 15 tonne GVM for TL-3 TMAs; available TMAs updated Diagrams updated, removal of mobile works diagrams Metropolitan Region Map updated	Whole document Whole document Section 4.1 Section 4.1 Section 4.4 Section 5 Section 7.1.1 Section 7.1.2 Appendix A Appendix C Appendix E
2.0	July 2024	Updated WHS laws Mandatory use of TMAs relocated to Traffic Management for Works on Roads Code of Practice Use of TMAs for Incident Response and Emergency Works relocated to Traffic Management for Works on Roads Code of Practice Other use of TMAs section relocated to Traffic Management for Works on Roads Code of Practice Removal of Advance Warning VMS, blocker vehicle requirements relocated to Traffic Management for Works on Roads Code of Practice Host Vehicle updates: carrying equipment, headrest	Section 1 Section 4.1 Section 4.2 Section 4.3 Section 5 Section 7.1

		New section – Main Roads accepted TMA units	Section 7.2.2
		Qualifications: pre-requisites removed, and Traffic Management for Works on Roads Code of Practice referenced	Section 8
		Metro Region Map Removed	Appendix E
2.1	March 2025	Traffic Management arrangement relocated to Traffic Management for Works on Roads Code of Practice	Section 5
		TMA Deployment Example Diagrams relocated to Traffic Management for Works on Roads Code of Practice	Appendix C

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1. INTRODUCTION

Main Roads has adopted the Safe System approach to the management of the road network, recognising that humans make mistakes which can lead to death or serious injury. Truck Mounted Attenuators (TMAs) accommodate for human error by protecting road workers and preventing road trauma by reducing crash forces to survivable limits.

This Code of Practice (previously referred to as a guideline) has been produced for the deployment of TMAs in Western Australia to protect worksites on or beside active roads against errant vehicle intrusion. TMAs may be deployed to protect short to medium term maintenance or construction works where it is not practical to close the road or deploy temporary safety barriers for the protection of workers. They may be deployed as 'barrier' or 'shadow' vehicles depending on the static or mobile nature of the works.

A TMA is defined as a combination of Host Vehicle (Truck) and Impact Attenuator Unit, mounted on the Host Vehicle to protect road workers. The Impact Attenuator Unit, also known as a crash cushion or crash attenuator, is a device intended to reduce the damage done to structures, vehicles and motorists resulting from a motor vehicle collision. Impact Attenuator units are designed to absorb the vehicles' kinetic energy and/or redirect the vehicles away from the hazard, and from roadwork machinery or workers.

TMAs are used for the protection of works on or adjacent to high-speed roads with high traffic volumes. Their major application is for the set up or short-term protection of works on or adjacent to Freeways or High-Speed Multilane Carriageways (where they are mandatory, see Traffic Management for Works on Roads Code of Practice).

The following Acts, Regulations, Standards and Code of Practice are applicable to this work: Work Health and Safety Act 2020, Work Health and Safety (General) Regulations 2022, Main Roads Act 1930, Road Traffic Code 2000, Australian Standard 1742.3, Austroads Guide to Temporary Traffic Management (AGTTM) and the Traffic Management for Works on Roads Code of Practice.

This Code has been prepared following extensive consultation with Local Government, industry and other stakeholders through Advisory Group meetings and the TMA Operation Working Group meetings.

We also acknowledge the VicRoads Guidelines for the use of Truck Mounted Attenuators – TMAs and the National Guidelines for the Use of Truck and Trailer Mounted Attenuators (National TMA Guidelines).

2. PURPOSE

The primary objective of this Code is to improve the safety of road workers through providing physical protection via TMAs against errant vehicle intrusion into worksites when road closure or temporary safety barriers are not reasonably practicable. TMAs also protect the occupants of errant vehicles through attenuating an impact that would otherwise be absorbed by a works vehicle. The secondary objective is to provide standardised guidance for planning works involving TMAs including training and education of TMA operators and a consistent approach to the use of TMAs in Western Australia.

3. DEFINITIONS

Term	Description / Explanation
AGTTM	Austroads Guide to Temporary Traffic Management.
AIB	Automatic Impact Brake. A system that, in the event of an impact with the rear of the Impact Attenuator Unit, will apply the brakes of the TMA host vehicle automatically. The system must apply brakes on all wheels of the rear axle/s of the host vehicle.
AS1742.3	Australian Standard 1742.3 – 2019, Traffic Control Devices for Works on Roads.
Barrier Truck	Refers to the TMA host vehicle.
Competent Person	Person who has, through a combination of training, qualification and experience, acquired knowledge and skills enabling that person to correctly perform the specified task.
Grade Separated Road	A road that is separated so that all crossing movements, which would otherwise conflict, are at different elevations.
GVM	Gross Vehicle Mass. The maximum loaded mass of a vehicle: (a) Stated on the vehicle's compliance plate; or (b) Stated in a way prescribed under a regulation.
High Speed Road	Posted speed limit of 90 km/h or more.
Impact Attenuator Unit	An Impact Attenuator Unit, also known as a crash cushion or crash attenuator, is a device intended to reduce the damage done to structures, vehicles and motorists resulting from a motor vehicle collision. Impact attenuator units are designed to absorb the vehicles' kinetic energy and/or redirect the vehicles away from the hazard, and from roadwork machinery or workers.
IPPV	Impact Protected Push Vehicle (see section 7.1.1).
MASH	Manual for Assessing Safety Hardware.
Multilane	Two or more running lanes in one direction.
NCHRP	National Cooperative Highway Research Program.
State Road	For this Code 'State Road' refers to roads that have been declared 'highways' or 'main roads' and are managed by the Commissioner of Main Roads under the provisions of the Main Roads Act 1930. May also be referred to as Main Roads road.
TARE Mass	The unladen mass of the vehicle only, i.e. not carrying a load.
TL2	Test level 2. Applies to Impact Attenuator Units that meet either NCHRP or MASH Test level 2 (basic) requirements (TL2) 70km/h (see section 7.2).
TL3	Test level 3. Applies to Impact Attenuator Units that meet either NCHRP or MASH Test level 3 (basic) requirements (TL3) 100km/h (see section 7.2).

TMA	Truck Mounted Attenuator. A combination of Host Vehicle and Impact Attenuator Unit, mounted to the Host Vehicle to protect road workers. The combination must meet the requirements of this document.
Traffic Lane	Portion of the roadway allotted for single line of moving vehicles.
VMS	Variable Message Sign

4. PARAMETERS FOR WHEN TO USE TMAS

4.1 Mandatory use of TMAs

The Traffic Management for Works on Roads Code of Practice details the roads and localities where TMAs must be used to protect the work area.

Where a TMA is used on a Freeway or road with a permanent speed limit of 90 km/h or more it must be a TL-3 TMA. Refer to section 4.3 for details on where approved MASH TL-2 TMAs are permitted.

Figure 1 – Example TL-2 TMA

Source: A1 Roadlines Pty Ltd

Figure 2 – Example TL-3 TMA

Source: A1 Roadlines Pty Ltd

4.2 Incident Response and Emergency Works

When responding to incidents and/or emergencies there are many different risks to consider compared with planned works. It is recognised that it will generally not be possible to set up the site to be fully compliant with temporary traffic management requirements, including the use of TMAs where required.

Refer to the Traffic Management for Works on Roads Code of Practice for more details of what must be considered.

4.3 MASH TL-2 TMAs

Approved TL-2 TMAs are NOT permitted:

- on roads with permanent speed limit greater than 80 km/h; or
- on Freeways or other high speed multi-lane roads, where TL-3 TMAs are mandatory (refer Traffic Management for Works on Roads Code of Practice).

When using a TL-2 TMA the following must apply:

- the use of the TL-2 TMA is supported by a risk assessment[1]
- if the permanent speed limit exceeds 60 km/h:
    - the TMA must be within a temporary speed limit of 60 km/h or less; or
    - the TMA may be used during traffic management set up and pack up with a 60 km/h temporary regulatory speed limit displayed on the TMA variable message sign.

Due to the departures in host vehicle requirements (refer section 7.1.2), TL-2 TMAs are not recommended to be used in the following situations, where TL-3 TMAs are preferred:

- roads with a high percentage of heavy vehicles (greater than 10%), or
- roads with a permanent speed limit of 80 km/h, or
- for mobile work operations.

The TMA driver should exit the vehicle, if safe to do so, once the TMA is deployed, this should be based on a risk assessment.

The TL-2 TMA host vehicle must have the unloaded mass and GVM of the vehicle and its test level rating clearly marked on some conspicuous part of the right-hand side of the vehicle, in letters at least 50 millimetres high and 25 millimetres wide.

Note: only Main Roads approved MASH TL-2 TMAs are permitted for use in Western Australia, the host vehicle requirements are specified in 7.1.2 of this document.

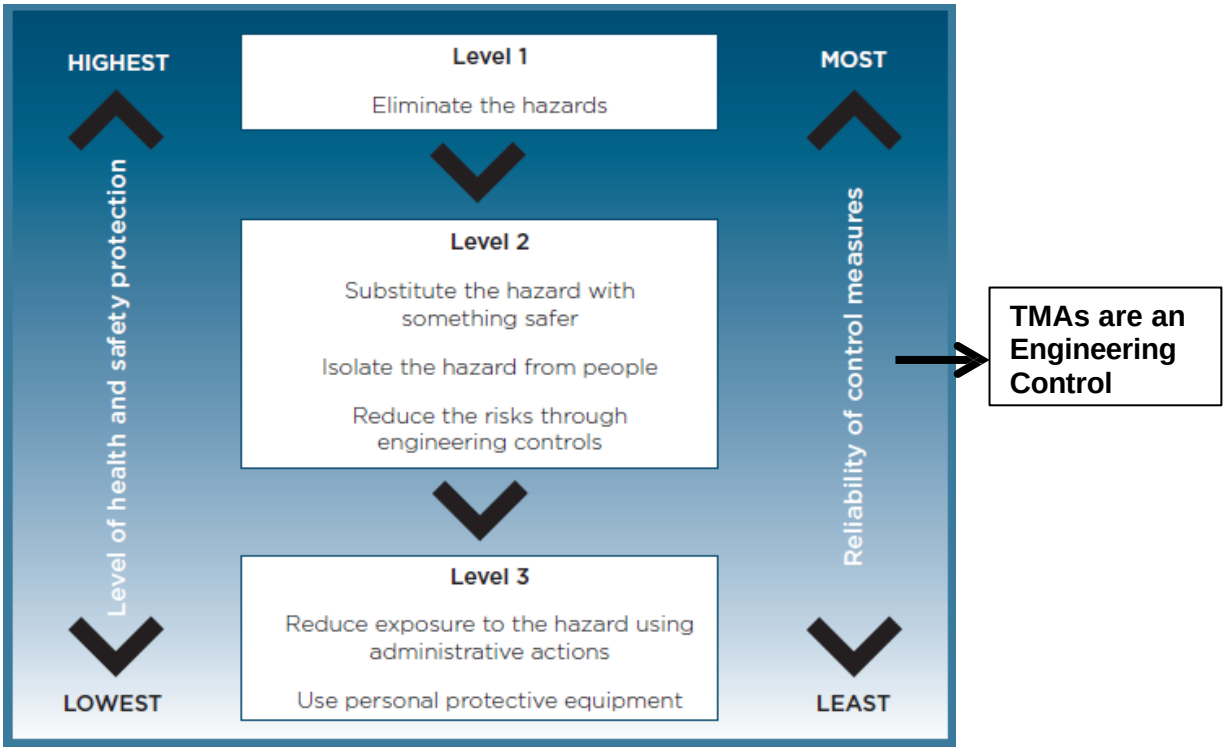
5. TRAFFIC MANAGEMENT ARRANGEMENTS

Refer to the Traffic Management for Works on Roads Code of Practice and Austroads Guide to Temporary Traffic Management requirements for required traffic management arrangements when using TMAs.

[1] If a risk assessment determines the use of the TL-2 TMA is considered appropriate the roll-ahead distance must be considered to ensure the safety of workers.

6. RISK MANAGEMENT

For works where it is not practicable to close the road (due to unacceptable traffic congestion or unsuitability of alternative routes) the positive physical protection provided by a TMA is both a practical short-term control and a proven level 2 safety control. TMAs are used in most states of Australia and have prevented fatalities and serious injuries during their deployment.



Limitations of TMA use

TMAs are useful on high-volume high-speed roads. However, where works are long term in nature, additional protection for workers and road users (such as road safety barriers) is often more appropriate. This is to ensure the risk of lateral worksite intrusion by errant vehicles is mitigated.

7. TECHNICAL SPECIFICATIONS

7.1 Host Vehicle

This section provides standard functional specifications for the host vehicle. This includes areas such as seating, seatbelt harnesses, masts, visibility of the host vehicle and standard control panel arrangement.

The host vehicle must conform to the following requirements (except as allowed for at clause 7.1.1 and 7.1.2):

a) In some cases, a full engineering analysis by a suitable qualified person, supported by testing where applicable, will be necessary before the modified vehicle is accepted. This testing may include determination of front axle loading when the impact attenuator unit is deployed.

b) Be approved for on road use by the Department of Transport (DoT).

c) Be a minimum of 15 tonnes GVM. (Refer to Appendix A).

d) Be a single cab truck with an automatic transmission.

e) The mounting of any fixtures are to be engineered to 20 times the weight of the fixture.

f) Be painted a distinctive bright colour. The colour should contrast with the colour of high-visibility clothing used by personnel. The vehicle should also be fitted with retro-reflective rear marking plates in line with DoT requirements.

g) Be fitted with an Automatic Impact Brake (AIB) system that, in the event of an impact with the rear of the Impact Attenuator Unit, will apply the brakes of the TMA host vehicle automatically. In the event of such incidents, it is critical to have an isolation switch or system which will allow the AIB system to be deactivated, this will allow for the impacted TMA vehicle to be removed from positions or locations that could cause an unnecessary obstruction or blockage to the roadway.

As a minimum, the AIB System must apply the brakes on all wheels of the rear axle/s of the host vehicle. It is recommended, that the AIB system be fitted, so activation of the system is automatic when the Impact Attenuator unit is fully deployed, and the host vehicle is travelling at a speed no greater than 40 km/h The AIB system must only be activated when the Impact Attenuator unit is fully deployed.

Note: *Modification of the braking system will affect ADR compliance and require approval through the DoT.*

h) Be fitted with an AS /NZS 4192 'Illuminated flashing arrow signs' approved size "C" arrow-board. The arrow board assembly must be positioned on the truck in accordance with the requirements of AS1742.3 (it is recommended the arrow board be two sided to allow the vehicle to be used for mobile works on two-lane two-way roads).

i) The arrow board and its mountings must be engineered to a standard:

- That will allow for them to withstand the forces applied during forward travel motion based on maximum speed environment for heavy vehicles when travelling to site i.e. 100km/h; and
- To withstand a force of 20 times the total weight of the arrow board and its mountings; and
- If the arrow board assembly is designed to lift and lower it must lift or lower within 15 seconds.

j) Have an 'in-cabin' control panel placed in close proximity to the operator and illuminated at night. The panel shall include methods of control for, but not limited to, the following:

- Activation of communication equipment
- Activation of Warning lights
- Activation of Arrow Board
- Raising and lowering of Arrow board if applicable
- Activation of rear-view camera
- Raising and lowering of the Impact Attenuator Unit.

k) Have cabin controlled Variable Message Signs (VMS) to further warn drivers of potential hazards and work zones in line with the TMA Work instructions. VMS displays may be pictorial and/or descriptive.

l) All seating within the TMA host vehicle that will be occupied while the TMA is deployed shall be fitted with an approved four-point harness seatbelt and mountings. Four-point harnesses are only to be used when the host vehicle is being used in attenuator mode and must be used in conjunction with the vehicle's standard seatbelts.

All new vehicles must be fitted with seats equipped with an integrated harness.

m) Prevention of Rearward Seat Collapse.
To reduce the likelihood of rearward seat collapse in the event of a substantial rear impact:

1. The driver's seat (and any other seat that will be occupied) and seat mountings must be of sufficient strength to prevent rearward seat collapse when subjected to a loading of 740 ± 20 daN (*daN - decanewton, a metric unit of force equal to 10 newtons*) supplemented by a force equal to 6.6 times the mass of the complete seat

Note: *This loading must be applied horizontally rearward through the centre of mass of the seat/occupant combination and must be sustained for at least one second,*

Or;

2. An engineered and certified device, designed to restrict rearward seat collapse when the driver's seat and seat mountings are subjected to the loading described in sub clause 1) *see above*, must be installed behind the driver's seat.

Note: *The device should not increase the likelihood of injury to the seat occupant.*

Reference Appendix B for further information on rearward seat collapse.

n) Be fitted with high strength headboards to prevent debris from crashing through the cabin in the event of an impact.

Where a headboard is not practical other cab protection that has been engineered and certified to protect occupants from debris is acceptable.

o) Due to the intended use of the vehicle, the risk of rear impact is greatly increased when compared to a standard load carrying vehicle. The vehicle is licensed as a Special Purpose Vehicle, and therefore, the carriage of equipment in the load space not needed specifically for the operation of the vehicle is prohibited.

p) The seat is to be fitted with an adjustable headrest to prevent operator whiplash during an errant vehicle impact. Any replacement seat fitted to the truck must not affect the truck's compliance with all Australian Design Rules applicable at the date of manufacture. (eg ADR 3/.. Seats and Seat Anchorages, ADR 4/.. Seatbelts, ADR 5/.. Anchorages for Seatbelts, etc)

q) Be fitted with a minimum of two flashing yellow lamps positioned on the vehicle in accordance with the requirements of AS1742.3.

r) Have mounting facilities for signs to be mounted to the tailgate or headboard that are secure and safe; that will not create dangerous projections, obscure lighting or registration plates, or cause the vehicle to exceed statutory dimension limits.

s) As a minimum be fitted with communication equipment that will enable simultaneous and independent communication to all relevant personnel, e.g. - 2 (two) 5 watt 41 channel UHF radios, operating on separate channels.

t) Be equipped with an air horn of sufficient intensity and volume to be easily heard by workers carrying out their normal duties to warn of a vehicle approaching at a dangerous speed or on the off road side of the TMA.

u) Have an independent power back up system installed that will adequately cater for all auxiliary equipment associated with use of the host vehicle as a TMA. For example, this may include the installation of auxiliary batteries or power packs.

v) Be fitted with a camera to allow the TMA operator to observe traffic approaching from the rear.

Note: *Consideration should be given to the use of cameras suitable for both day and night operations, and installation of an associated data recording device to record vehicles approaching from potential impact areas.*

7.1.1 Special Build Incident Response Vehicles

The Main Roads Incident Response Service (IRS) deploys specially trained, mobile road crews on Perth's freeways to assist with the quick and safe removal of broken down vehicles, debris and other obstructions, helping to restore normal traffic conditions as quickly as possible. As part of this service Main Roads uses a special build Impact Protected Push Vehicles (IPPV).

To protect the occupants of the IPPV, Main Roads will mount an Impact Attenuator Unit to these vehicles. They will only be designed and built with MRWA approval and the approval from the DoT. A risk assessment was undertaken on TMAs and found that they were not suitable for the IRS role due to:

- Inadequate manoeuvrability on site at incidents.
- Inability to respond within designated response times.
- Inability to maintain a Cold side exit (may be dual cab where required).
- Inability to travel to incident site in Emergency Lane (width restrictions).

Having an IRS vehicle that met all of the TMA host vehicle requirements would not allow the incident response service to be delivered with an impact attenuator unit, thereby putting the occupants, as well as road users, at more risk of incidents.

Therefore, these special build IPPV are required to meet all the Host Vehicle requirements of 7.1 with the following exemptions:

- Will not be required to have 15 tonne GVM, however must be at least 9 tonnes tare;*
- The vehicle can be a dual cab;
- Do not require an air horn to be fitted;*
- Do not require independent power back up (as unlike normal TMAs for roadworks, an IPPV will not be required to remain off and stationary for long periods of time).

**Items not exempt for IPPV's licenced after publication of this Code.*

These vehicles will not be referred to as a Truck Mounted Attenuator (TMA) but will have some characteristics of a TMA. When requiring these special build vehicles, the builder and designer shall be made aware of the requirements in this Code, and they will be referred to as IPPVs. The unit shall be marked 'NOT A TMA' in letters at least 50 mm high.

Note: Operators of IPPVs must obtain accreditation in Operate Truck Mounted Attenuator (see section 8).

7.1.2 MASH TL-2 Host Vehicle Specifications

TL-2 TMAs must meet all Host Vehicle requirements outlined in section 7.1; however, the Host Vehicle is exempt from the following:

- Is not required to have 15 tonne GVM. The host vehicle must be a heavy vehicle, with GVM of 4,501 kg or more (rerated light vehicles or ballast is not permitted). The combined mass of the TMA host vehicle (including all host vehicle requirements detailed above) and attenuator unit must be at least 3,300 kg (no additional ballast is permitted);
- Is not required to have automatic impact brakes;
- Is not required to have seat mountings engineered to prevent rearward seat collapse, as per section 7.1 (m).
- May be fitted with an Illuminated flashing arrow signs approved size "B" for lower speed environment, i.e. C size not required.

TL-2 TMAs are only used:

- Under the conditions outlined in section 4.3, and
- In accordance with the operational procedures in section 7.6 below.

7.2 Impact Attenuator Unit Certification

Impact Attenuators Units shall meet all mandatory and optional testing requirements of the following:

- NCHRP 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features (1993) for Impact Attenuator Units built before the introduction of the following standard.
- AASHTO Manual for Assessing Safety Hardware (MASH) for all other Impact Attenuator Units.

Typical form of evidence for compliance would be or may include United States of America Federal Highway Administration (FHWA) acceptance letter report of that particular make and model.
As of April 2018, all new Impact Attenuator Units shall be submitted to the Austroads Safety Barrier Assessment Panel (the Panel). All submissions received by the Panel must be in accordance with AASHTO's MASH guidelines or an equivalence rating to MASH in accordance with AS/NZS3845 Parts 1 and 2.

Impact Attenuator Units that do not meet the MASH guidelines will no longer be accepted by the Panel after 31 December 2020.

Main Roads will work with relevant stakeholders to determine an appropriate transition period to the MASH requirements and allow current approved Impact Attenuator Units to continue to be used after 31 December 2020 to ensure current TMA owners are not financially disadvantaged.

TMAs that have not previously been licenced by the Western Australian Department of Transport must have impact attenuator units that have met MASH guidelines and been approved for use by Main Roads (see section 7.2.2).

7.2.1 Impact Attenuator Unit Test Level Ratings:

The following table indicates Impact Attenuator Unit ratings.

Rating	**Speed**
TL2	70 km/h
TL3	100 km/h

Impact Attenuators Units shall have their test level rating clearly displayed on both side panels of the unit. The display shall be made up of a panel with black lettering (e.g. TL3) on a white 210mm x 300mm background.

7.2.2 Main Roads Accepted Attenuator Units

The below TMA units have been accepted by Main Roads for crashworthiness, (note: must be used in combination with a compliant TMA host vehicle, as per this Code).

TMA Name	**Test Level**	**Date of Acceptance**
MASH TL-3 Scorpion II TMA	MASH TL-3	15 March 2019
MASH Scorpion II TL-2 Truck Mounted Attenuator	MASH TL-2	10 January 2022
Silke MASH Truck Mounted Attenuator (TL 3)	MASH TL-3	30 November 2022
Verdegro Blade TMA (MASH TL 3)	MASH TL-3	27 August 2018

7.3 Truck Mounted Impact Attenuator Unit

Host vehicle shall be as detailed in section 7.1.

a) Impact Attenuator Units shall be assembled and fitted to the host vehicle in accordance with the manufacturer's specifications.

b) All units to be fitted with flashing beacons that will be visible from all angles, the lights should have a variable flashing pattern. The objective being to ensure the TMA is visible to vehicles approaching from behind or in front of the TMA.

c) The rear surface of the Impact Attenuator Unit when deployed must consist of Class 1W retro reflective red diagonal striping at least 100 mm wide, on a white **non**-retro reflective background.

7.3.1 Truck Mounted Impact Attenuator Unit Configuration

In addition to the requirements above the following apply:

a) Dedicated yellow flashing light to automatically provide notice of the Impact Attenuator Unit being raised or lowered.

b) Automatic Impact Brake micro-switch is to be fitted to the rear of the Impact Attenuator Unit to activate the host vehicle brakes in the event of an impact.

c) In cabin and external audible alarms to automatically provide notice of the Impact Attenuator Unit being raised or lowered.

d) Travel lock system installed that prevents inadvertent deployment of the Impact Attenuator Unit.

e) When not deployed an adhesive type (black on yellow) warning sign stating: 'Caution keep clear this unit may lower at any time' must be visible from the rear of the Impact Attenuator Unit.

7.4 Trailer Mounted Attenuators

Due to issues such as the potential for gating into adjacent traffic lanes, the difficulty of correctly attaching them and issues with manoeuvrability Trailer Mounted Attenuators are not permitted in WA.

7.5 TMA Repairs, Modifications and Inspections

a) After an impact or crash that may affect the integrity of the host vehicle and/or impact attenuator, TMAs and attachments must be inspected by a competent person.

b) All repairs and/or modifications to TMAs and attachments must be carried out by a competent person.

c) Following repair or modification TMAs and attachments must be inspected and have certification documentation prepared by a competent person.

d) TMAs and attachments must be inspected at least once each year and have certification documentation prepared by a competent person.

e) TMAs must be inspected for fatigue cracking in the mounting brackets at suitable intervals or as specified in the manufacturer's manual by a competent person. These inspections must be recorded in the unit's maintenance logbook.

7.6 Operational Procedures

The following shall be observed when operating a TMA:

a) When performing the duties of the TMA all occupied seating must have the same level of occupant protection as the driver's seat.

b) The attenuator may be lowered into operational position while stationary and clear of traffic lanes or once in moving convoy at a maximum speed of 40km/h (the operator must ensure no vehicles are in the lowering area of the attenuator).

c) While TMAs are deployed, and the host vehicle is occupied all occupants must use the four-point harness seat belt. At longer term stationary work sites operators may exit the host vehicle when the TMA has been deployed and the site is set up. Operators exiting the vehicle must do so in a safe manner, i.e. ensure it is safe to exit using the rear camera and/or mirrors, ensure gaps in traffic, move away from the vehicle as soon as possible, limit entering and exiting the vehicle as much as possible, etc.

d) When the Impact Attenuator Unit is in the deployed or lowered position, the vehicle may only travel within its own lane or carry out lane-changing manoeuvres in the same direction. The Impact Attenuator Unit must be raised when carrying out all other manoeuvres.

e) TMAs deployed as stationary barrier vehicles are to be parked with brakes on and with wheels directed straight ahead. Directing the steering to one side can result in the TMA rolling when impacted or being directed into adjacent traffic lanes.

f) The Impact Attenuator Unit must only be in the deployed/lowered position when the TMA is engaged at an approved road work site, event or incident. This must include the preparation and disassembly of an approved Traffic Management Plan.

7.7 Traffic Control Devices

All traffic control devices are to conform to the requirements of AS1742.3 and the Traffic Management for Works on Roads Code of Practice.

7.7.1 Vehicle Mounted Signs and Devices

All vehicle mounted warning devices must be in accordance with the requirements contained in AS1742.3 and Traffic Management for Works on Roads Code of Practice. This includes all signs, illuminated flashing arrow sign and flashing yellow lamps.

- Illuminated Flashing Arrow Sign

Flashing yellow lamps may be used in conjunction with this sign provided that the lamps are either appropriately shielded or laterally or vertically displaced from the edge of the sign to avoid visually corrupting the arrow shape or its directional effect.

It is recommended to have an arrow on both sides of the vehicle so it can be used for mobile works on two-way two-lane roads.

- Variable Message Sign

All Portable Variable Message Signs must meet relevant Australia Standards, comply with applicable DoT requirements such as ADR, meet registration requirements and be approved for on road use.

7.7.2 Advance Warning Vehicles

Advance Warning Vehicles warn and inform of changes to traffic conditions ahead and give motorists time to adjust their driving patterns.

Advance warning vehicles shall have 'B' size arrow board or variable message board. All signs must be securely fixed to the advance warning vehicle.

8. QUALIFICATION CRITERIA FOR TMA OPERATORS

It is mandatory to conduct training in TMA operation with a MRWA approved training provider and gain an Operate Truck Mounted Attenuator accreditation before operating a TMA.

Refer to section 8 of the Traffic Management for Works on Roads Code of Practice.

Note: Operators of IPPV will be required to hold the accreditation but may be offered exemptions for traffic management experience and/or heavy vehicle operation experience. Exemptions shall be obtained from the Main Roads WA Road Safety Branch.

APPENDIX A

15 Tonne Gross Vehicle Mass (GVM) Requirement for TL-3 TMA Host Vehicle

Critical to the development of a TMA that affords protection to the public, the road workers and the TMA operator, is the selection of the host vehicle. The vehicle must be appropriate for the use intended and also comply with all legislative requirements.

There are a number of requirements that affect the selection of the host vehicle. A discussion of critical requirements follows.

Minimum Tare Mass
For acceptable impact performance, minimum tare mass requirements for host vehicles are set by the manufacturers of impact attenuator units. The four currently available impact attenuators have minimum host vehicle tare mass requirements of:

- 7.3 tonnes (Safe Stop)
- approximately 9.07 tonnes (20,000 lbs) (Scorpion).
- 8.5 tonnes (Verdegro Blade)
- 6.804 tonnes (Scorpion II)

The host vehicle tare mass is the mass of the truck with all the components necessary for operation as a TMA.

Weight Distribution
To enhance the effectiveness of the Automatic Impact Braking System (AIB) the rear axle/s should carry a significant proportion of the total TMA mass.

Use of Ballasting
The use of ballasting is discouraged. The mounting points of all attachments to a TMA host vehicle are required to withstand a force of twenty times the mass of the attachment. While the attachment of the ballasting to the truck body may meet this requirement, the attachment of the body with ballast to the chassis is unlikely to meet the twenty times mass requirement without significant modification to the mounting points on both the body and to the truck chassis.

Chassis Size and Strength for Impact Attenuator Unit Mounting
Under impact the loads imposed on an impact attenuator unit are transferred through the mounting assembly into the chassis of the truck. The truck chassis must be of a size that allows mounting of the impact attenuator unit in accordance with the manufacturer's specifications. The truck chassis must also be of sufficient strength to absorb applied loads without significant failure or distortion.

Conclusion
It is likely that TL-3 TMA host vehicles with a manufacturer's gross vehicle mass (GVM) rating of at least 15 tonnes will meet the above critical requirements.

Vehicles with a lesser GVM rating are not as likely to meet the above critical requirements and must be engineered and certified to meet the requirements listed above.

APPENDIX B

Prevention of Rearward Seat Collapse.

Background

Qld Transport and Main Roads experienced a TMA incident where the driver's seat failed in a rearward direction. The drivers head hit the rear of the cabin and the driver also suffered back injuries which have permanently prevented his return to work.

Rearward Seat Collapse

The purpose of this requirement is to reduce the likelihood of rearward seat collapse in the event of a substantial impact to the rear of a TMA. This will reduce the likelihood of injury to a TMA occupant.

The purpose of this requirement may be achieved by either of two methods:

1. By design or testing, determine that the seat and mountings are of sufficient strength to withstand in the rearward direction, similar loading to that applied to the seat and seat mountings in a forward direction for Australian Design Rules (ADR) compliance.

2. By fitting a device behind the seat to restrict rearward seat collapse when the same loadings are applied in a rearward direction.

The rearward loading requirements are based on ADR 5/05 requirements.

ADR 5/05 relates to seat belt anchorage strength required to restrain an occupant in a frontal impact. In a rear impact the seat belt has no effect and rearward movement of the occupant is restrained by the seat structure and seat mountings only.

The TMA Code requirement is intended to afford a seat occupant a similar level of protection in the event of a rear impact that the ADRs provide in a frontal impact.

ADR 5/05 requires that for heavy goods vehicles (GVM > 12t) with lap belt anchorages located wholly within the seat structure the seat and the belt anchorages must withstand the following loading in the forward direction:

A test load of 740 ± 20 daN supplemented by a force equal to 6.6 times the mass of the complete seat.

The TMA Code requirement imposes the same loading in a rearward direction to simulate the effects of a rear impact.

Evidence of compliance with these rearward loading requirements can be either by design verification or by representative test results. This evidence would give blanket cover (type approval) to that seat/vehicle combination and the vehicle/seat supplier or verifying engineer would supply certification of same.

If evidence of compliance with additional rearward loading requirements is not available, a device to prevent rearward seat collapse would be fitted.

***Note**: ADRs require that to test seat and seat anchorage strength, a rearward longitudinal deceleration of 20g is applied to the whole shell of the vehicle, without an occupant.*

Given this requirement and that the seat assembly is certified to withstand applied loads in a forward direction, the original equipment seats may meet the TMA Code requirements.

Appendix C - Indicative Safe Work Method Statements for TMA Operation
Example Work Instruction

Using Impact Attenuator to set up Lane Closure on Multi Lane Road

Steps	Hazard	Additional PPE	Notes/Controls
• Consider potential hazards and control measures. • Undertake and complete a risk assessment.	Hit by fast moving vehicle		• No work to be undertaken during rain periods or poor visibility • Undertake mandatory daily pre-start meeting prior to commencing. • Do not allow personnel to cross the road on foot • Consider the speed and road environment. • Consider lane closure restrictions • Consider police attendance and/or speed enforcement
Ensure plant has been serviced and adjusted	Defective plant		• Perform pre-start check of vehicle and fittings as (lights, attenuator, horn, oil, water, etc.) • Complete defect notice • Fill in log book
Specify appropriate traffic control strategy to suit work area.		High Visibility Garments	Refer to TMP
All vehicles shall have a reliable communication system	Comms system not working		All vehicles fitted with UHF radios, test communication at the time of pre-start check.
Notes specific to Barrier Truck and driver • While the attenuator is deployed and the host vehicle is occupied all occupants shall use the four point harness seat belt. • At longer term worksites when the site is set up and the TMA is deployed the driver may exit the vehicle. Operators exiting the vehicle shall do so in a safe manner, i.e. ensure it is safe to exit using the rear camera and/or mirrors, use gaps in traffic, move away from the vehicle as soon as possible, limit number of times exiting and entering vehicle, etc. • No personnel are to remain behind, beside or within the No Go of the barrier truck. • The barrier truck driver shall use air horns fitted to the truck to highlight a dangerous situation to warn personnel in the work zone. • Once the procedure commences the driver of the barrier truck in consultation with the site supervisor has the authority to order all vehicles off the road if the driver believes the situation has become dangerous.	Struck by vehicle		Ensure correct buffer distance
Determine the work area from works order or supervisors instructions			Consider the site risk assessment including inclement weather, traffic flow, speed environment and poor visibility etc.
Preparation for Lane Closure • Work vehicles to be positioned in front of barrier vehicle a suitable distance before work site • All vehicles shall activate beacon lights and/or arrow boards • The attenuator may be lowered into operational position while stationary and clear of traffic lanes or once in moving convoy at a maximum speed of 40km/h (the operator shall ensure no vehicles are in the lowering area of the attenuator)	Vehicle crash and lowering attenuator onto vehicle		• Flashing beacon lights and/or arrow boards to be used. • All vehicles to stay in constant contact via UHF radio. • Barrier truck driver to use discretion when lowering attenuator.

Establish traffic control • Traffic control is to be in accordance with Traffic Management Plan. • Barrier Truck to shadow traffic control vehicle while approach signs are being erected. This may include temporarily positioning the barrier vehicle in the traffic lane to protect the workers erecting signs. • Barrier Truck to shadow traffic management personnel by being positioned in the traffic lane while traffic cones in the taper are being placed. • Barrier Truck then follows in the closed lane as the traffic cones are placed along the lane line.	Struck by passing vehicles Hit by debris	High visibility garments	• Traffic control as per TMP • Barrier vehicle with attenuator in position • Beacon lights and/or arrow boards in operation • All vehicles to stay in constant contact via UHF radio • Barrier truck driver to sound air horn if unsafe traffic situation arises • Ensure that approaching traffic has minimum 200m sight distance to the barrier truck • Consider police attendance and/or speed enforcement • Do not allow personnel to cross the road on foot
Do the work • When the lane has been closed the barrier truck may be positioned in the closed lane. • Within a lane closure the barrier truck driver may safely exit the vehicle to work with the crew ensuring they exit in a safe manner.	Struck by vehicle		Refer to site risk assessment
Remove Traffic Control • Traffic control devices shall only be removed when the work area has been packed up. • To remove a taper the barrier truck should drive around to the start of the taper as with setup. • Barrier truck protects the closed lane while the taper is removed. • When re-entering traffic the vehicles shall accelerate in the lane, deactivate beacon lights and arrow boards and continue as part of general traffic. • The attenuator may be raised at a maximum speed of 40 km/h	Vehicle crash		All vehicles to stay in constant contact via UHF radio

Using Truck Mounted Attenuator in Mobile Works on Multi Lane Roads

Steps	Hazard	Additional PPE	Notes/Controls
• Consider potential hazards and control measures • Undertake and complete a risk assessment.	Hit by fast moving traffic		• No work to be undertaken during rain periods or poor visibility • Undertake mandatory daily pre-start meeting prior to commencing • Consider the speed and road environment • Consider lane closure restrictions • Do not allow personnel to cross the road on foot • Consider police attendance and/or speed enforcement
• Ensure plant has been serviced and adjusted	Defective plant		• Perform pre-start check of vehicle and fittings as per PHS Total Fleet Management requirements (lights, attenuator, horn, oil, water, etc.) • Complete defect notice • Fill in log book
• Specify appropriate traffic control strategy to suit work area.		High Visibility Garments	Refer to TMP
• All vehicles shall have a reliable communication system	Communication system not working		All vehicles fitted with UHF radios Test communications at the time of pre-start check

Notes specific to Barrier Truck and driver • The barrier truck driver shall not exit the vehicle while in open traffic lanes. • No personnel are to remain behind, beside or within the No Go of the barrier truck. • The barrier truck driver shall use air horns fitted to the truck to highlight a dangerous situation to warn personnel in the work zone. • Once the procedure commences the driver of the barrier truck in consultation with the site supervisor has the authority to order all vehicles off the road if the driver believes the situation has become dangerous.	Struck by vehicle		Ensure correct buffer distance
• Determine the work area from works order or supervisors instructions			Consider the site risk assessment including inclement weather, traffic flow, speed environment and poor visibility etc.
Preparation for Lane Closure • Work vehicles to be positioned in front of barrier vehicle a suitable distance before work site. • All vehicles shall activate beacon lights and/or arrow boards. • Proceeding to work site all vehicles to remain as a convoy. • The attenuator may be lowered into operational position while stationary and clear of traffic lanes or once in moving convoy at a maximum speed of 40 km/h (the operator must ensure no vehicles are in the lowering area of the attenuator)	Vehicle crash Lowering attenuator onto vehicle		• Flashing beacon lights and/or arrow boards to be used. • All vehicles to stay in constant contact via UHF radio. • Barrier truck driver to use discretion when lowering attenuator
Establish traffic control • Traffic control is to be in accordance with the Traffic Management Plan. • One person is to act as the team leader co-ordinating the traffic control. They are to take the leadership role for all aspects associated with traffic control. • Impact Attenuator and work vehicle to slow down gradually to a stop as they approach the work site and if all tail vehicles are in position work may commence. • If parked on the shoulder, once tail vehicle is in position the Impact Attenuator is to move out into the trafficked lane. • Once the Impact Attenuator is positioned in the trafficked lane the work vehicle and workers may move into the closed lane. • Note that a minimum distance of 20 metres (depending on manufacturer shunt forward recommendation) is to be maintained between the work zone and the shadow vehicle. • The handbrake is to remain off when the Impact Attenuator is acting as the tail vehicle. • The barrier truck driver shall not exit the vehicle. • The work crew shall carry out works as per the appropriate works procedure	Struck by passing vehicles Hit by debris	High visibility garments	• Traffic control as per TMP. • Barrier vehicle with attenuator in position • Beacon lights and/or arrow boards in operation. • All vehicles to stay in constant contact via UHF radio. • Barrier truck driver to sound air horn if unsafe traffic situation arises. • Ensure that approaching traffic has minimum 200m sight distance to the barrier truck • Consider police attendance and/or speed enforcement • Do not allow personnel to cross the road on foot
Remove Traffic Control • All vehicles in the traffic lanes are to move away onto the shoulder or accelerate to combine with the passing traffic. • Work vehicles and barrier truck are to accelerate in their lane. Work vehicles	Vehicle crash		All vehicles to stay in constant contact via UHF radio

deactivate lights and arrow-boards. Barrier truck operator lifts attenuator before deactivating lights and arrow-board.			